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(54) OPTICAL DISK RECORDING DEVICE, OPTICAL DISK RECORDING METHOD, OPTICAL DISK AND OPTICAL DISK REPRODUCING DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To record a subdata string without having any effect on the reproducing of a main data string by a pit string and a mark string in a timing which does not affect position information of edges.
SOLUTION: The rising of a corresponding EFM signal S2D is set so as to be more advanced by a time equal to or larger than about periods 3Ts than the rising of a pulse for modulation MMP so that the changeover of the logical level of a modulation signal S3 corresponding to the pulse for modulation MMP becomes the timing separated from the timing of the rising of an EFM signal S2 by a prescribed period on the condition of reducing a pit width in pits equal to or larger than periods 7Ts. Thus, a disk identifying signal SC1 is recorded so that it does not effect edge information of respective pits becoming reproduction references of a digital audio signal and TOC data. Moreover, the erroneous binary identification of a reproduced signal RF is prevented by making the pulse with of the pulse for modulation MMP shorter than one

cycle of a channel clock CK.

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CLAIMS

[Claim(s)]

[Claim 1] Generate the 1st modulating signal with which signal level switches with the period of the integral multiple of a predetermined primitive period according to the main data streams, control a light beam on the basis of said modulating signal, and said light beam is irradiated at a disk-like record medium. In the optical disk recording device which carries out sequential creation of a pit and a land or a mark, and the tooth space with the die length of the integral multiple of the basic die length corresponding to said primitive period The optical disk recording device characterized by changing said pit or the width of face of a mark to the timing which estranged only predetermined distance from said pit or the timing corresponding to the edge of a mark about said pit or mark more than predetermined die length based on the data stream of **.

[Claim 2] The 1st modulating-signal creation means which creates said 1st modulating signal according to said main data streams, The 2nd modulating-signal creation means which modulates said 1st modulating signal and creates a double modulating signal according to the data stream of **, It has a record light modulation means to modulate said light beam according to said double modulating signal, and the optical

system which irradiates said light beam at a disk-like record medium. Said 2nd modulating-signal creation means A pulse width detection means to detect the pulse width of said 1st modulating signal, and to output a pulse width detection result, It responds to the data stream of said ** on the basis of said pulse width detection result. The signal level of said 1st modulating signal is reversed to the timing which estranged only the predetermined period from the timing corresponding to said pit more than said predetermined die length, or the edge of a mark. The optical disk recording device according to claim 1 characterized by having a modulating-signal processing means to create said double modulating signal.
[Claim 3] The optical disk recording device according to claim 1 characterized by changing said pit or the width of face of a mark so that the data stream of said ** may be modulated with a random number and it may correspond to this modulation result.
[Claim 4] Said modulating-signal processing means is an optical disk recording device according to claim 2 characterized by modulating the data stream of said ** with an M sequence random number, and generating said double modulating signal.
[Claim 5] The optical disk recording device according to claim 1 characterized by said predetermined die length becoming by die length about 6 times the die length of corresponding to said primitive period.
[Claim 6] The optical disk recording device according to claim 2 characterized by the period which reverses the signal level of said 1st modulating signal becoming division into equal parts mostly in the period over the timing corresponding to said pit more than said predetermined die length, or the center of a mark.
[Claim 7] The optical disk recording device according to claim 2 characterized by the period which reverses the signal level of said 1st modulating signal becoming in a period shorter than said primitive period.
[Claim 8] The data stream of said ** is an optical disk recording device according to claim 1 characterized by becoming by the discernment data stream which identifies said disk-like record medium.
[Claim 9] Said main data streams are optical disk recording devices according to claim 1 characterized by becoming by the enciphered data stream and the data stream of said ** becoming by the data stream required for discharge of encryption of said main data streams.
[Claim 10] With the die length of the integral multiple of predetermined basic die length, by carrying out sequential creation of a pit and a land or a mark, and the tooth space In the optical disk record approach which records the main data streams about said pit or mark more than predetermined die length The optical disk record approach characterized by changing said pit or the width of face of a mark to the timing which estranged only predetermined distance from said pit or the timing corresponding to the edge of a mark based on the data stream of **.
[Claim 11] The 1st modulating signal with which signal level switches according to

said main data streams with the period of the integral multiple of the primitive period corresponding to said basic die length is generated. Detect the pulse width of said 1st modulating signal, and it responds to the detection result of said pulse width, and the data stream of said **. The optical disk record approach according to claim 10 characterized by modulating said 1st modulating signal, creating a double modulating signal, modulating a light beam according to said double modulating signal, and irradiating said light beam at a disk-like record medium.
[Claim 12] The optical disk record approach according to claim 10 characterized by changing said pit or the width of face of a mark so that the data stream of said ** may be modulated with a random number and it may correspond to this modulation result.
[Claim 13] The optical disk record approach according to claim 11 characterized by modulating the data stream of said ** with an M sequence random number, and generating said double modulating signal.
[Claim 14] The optical disk record approach according to claim 10 characterized by said predetermined die length becoming by die length about 6 times the die length of corresponding to said primitive period.
[Claim 15] The optical disk record approach according to claim 11 characterized by generating said double modulating signal by reversing the signal level of said 1st modulating signal during a predetermined modulation period, and said modulation period becoming division into equal parts mostly in the period over the timing corresponding to said pit more than said predetermined die length, or the center of a mark.
[Claim 16] The optical disk record approach according to claim 11 characterized by generating said double modulating signal and said modulation period consisting of said primitive period in a short period by reversing the signal level of said 1st modulating signal during a predetermined modulation period.
[Claim 17] The data stream of said ** is the optical disk record approach according to claim 10 characterized by becoming by the discernment data stream which identifies said disk-like record medium.
[Claim 18] Said main data streams are the optical disk record approaches according to claim 10 characterized by becoming by the enciphered data stream and the data stream of said ** becoming by the data stream required for discharge of encryption of said main data streams.
[Claim 19] The optical disk characterized by having modulated said pit or the width of face of a mark in said pit or mark more than predetermined die length in the modulation part which estranged only predetermined distance from the edge in the optical disk with which sequential creation of a pit and a land or a mark, and the tooth space was carried out by the die length of the integral multiple of predetermined basic die length, and the main data streams were recorded, and recording the data stream of **.

[Claim 20] The optical disk according to claim 19 characterized by said modulation part becoming in a pit or the center of a mark.
[Claim 21] The optical disk according to claim 19 characterized by change of the pit by said modulation or the width of face of a mark becoming below by 10 [%] of said pit or the average width of face of a mark.
[Claim 22] The data stream of said ** is an optical disk according to claim 19 characterized by what it became irregular with the random number and was recorded.
[Claim 23] The data stream of said ** is an optical disk according to claim 19 characterized by becoming by the discernment data stream which identifies a record medium.
[Claim 24] Said main data streams are optical disks according to claim 19 characterized by becoming by the enciphered data stream and the data stream of said ** becoming by the data stream required for discharge of encryption of said main data streams.
[Claim 25] By detecting the return light obtained by the optical disk by irradiating a light beam, and carrying out signal processing of the regenerative signal with which signal level changes according to said return light In the optical disk regenerative apparatus which reproduces the data stream recorded on said optical disk Said regenerative signal by carrying out binary discernment a clock playback means to reproduce a clock signal based on said regenerative signal, and on the basis of said clock signal It has the 1st playback means which reproduces the main data streams, and the 2nd playback means which carries out signal processing of said regenerative signal on the basis of said clock signal, and reproduces the data stream of **. Said 2nd playback means A signal level detection means to detect the signal level of said regenerative signal and to output a signal level detection result, The optical disk regenerative apparatus characterized by having an average-value-ized means to detect and output the average value of said signal level detection result, and the 2nd discernment means which identifies the average value of said signal level detection result, and reproduces the data stream of **.
[Claim 26] Said average-value-ized means is an optical disk regenerative apparatus according to claim 25 characterized by having an addition means to integrate said signal level detection result and to output an addition value, a multiplier means to count addition with said addition means and to output counted value, and a division means to do the division of said addition value by said counted value, and to output said average value.
[Claim 27] Said signal level detection means or said average-value-ized means is an optical disk regenerative apparatus according to claim 25 which is the period when the signal level of said regenerative signal starts from predetermined reference level at, or falls, and is characterized by the thing of this period for which said signal level detection result at the time of a center is average-value-ized mostly alternatively beyond a predetermined period.

[Claim 28] Said signal level detection means or said average-value-ized means is an optical disk regenerative apparatus according to claim 25 characterized by processing said regenerative signal alternatively with a random number, and reproducing the data stream of said **.
[Claim 29] The optical disk regenerative apparatus according to claim 25 characterized by carrying out halt control of the playback of said main data streams based on the data stream of said **.
[Claim 30] The optical disk regenerative apparatus according to claim 25 characterized by canceling encryption of said main data streams based on the data stream of said **.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention is applicable to the listing device of a compact disk, a compact disk, and a compact disc player, concerning an optical disk recording apparatus, the optical disk record approach, an optical disk, and an optical disk regenerative apparatus. This invention is the timing which does not affect the positional information of an edge, and it enables it to record the data stream of ** refreshable by the optical pickup which reproduces this main data stream without affecting playback of the main data streams by the pit train and the mark train in any way by changing a pit or the width of face of a mark.
[0002]
[Description of the Prior Art] Conventionally, by carrying out eight-to-fourteen modulation (Eight to Fourteen Modulation), the pit train of 3T-11T is formed to the predetermined primitive period T, and the compact disk is made as [record / audio data etc. / by this], after carrying out data processing of the data stream with which record is presented.
[0003] On the other hand, the record section of administrative data is formed in the lead-in groove area by the side of inner circumference, and it is made as [reproduce / a desired performance etc. / alternatively] by TOC (Table Of Contents) recorded on this record section.
[0004] Thus, the sign which shows a manufacturer, a factory, a disk number, etc. is stamped on the inner circumference side of lead-in groove area, and the compact disk with which various data are recorded is made as [check / the hysteresis of a compact disk etc. / by viewing / by this].
[0005]

[Problem(s) to be Solved by the Invention] By the way, in such a stamp, it is thought by the ability checking the hysteresis of a compact disk that an illegal copy is discriminable with the existence of this stamp. However, this stamp has a fault with it difficult [to reproduce depending on the optical pickup of a compact disc player] by aiming at the check by viewing. When this identifies an illegal copy with a stamp, in order to reproduce a stamp, the playback device of dedication is needed separately after all.
[0006] In this case, if the information on refreshable ** can be recorded by the optical pickup which reproduces audio data without affecting playback of the audio data based on a pit train in any way, it will be thought that an illegal copy can be eliminated using the information on this **.
[0007] This invention tends to propose the optical disk recording apparatus which can record the information on ** refreshable by the optical pickup which reproduces the data based on this pit train etc. without having been made in consideration of the above point and affecting playback of the data based on a pit train etc. in any way, the optical disk record approach, the optical disk created by these, and the optical disk regenerative apparatus which plays this optical disk.
[0008]
[Means for Solving the Problem] In order to solve this technical problem, in this invention, it applies to an optical disk recording apparatus and the optical disk record approach, and this pit or the width of face of a mark is changed to the timing which estranged only predetermined distance from this pit or the timing corresponding to the edge of a mark about the pit or mark more than predetermined die length based on the data stream of **.
[0009] Moreover, it applies to an optical disk, this pit or the width of face of a mark is modulated in the pit or mark more than predetermined die length in the modulation part which estranged only predetermined distance from the edge, and the data stream of ** is recorded.
[0010] Moreover, it applies to an optical disk regenerative apparatus, and the signal level of a regenerative signal is detected, a signal level detection result is obtained, the average value of this signal level detection result is identified, and the data stream of ** is reproduced.
[0011] It applies to an optical disk recording apparatus and the optical disk record approach, and the data of ** can be recorded with a pit or the width of face of a mark without affecting playback about the timing of these pits or the edge of a mark, if this pit or the width of face of a mark is changed to the timing which estranged only predetermined distance from this pit or the timing corresponding to the edge of a mark about the pit or mark more than predetermined die length based on the data stream of **. Thereby, the information on ** can be recorded on playback of the data based on a pit train etc. refreshable by the optical pickup which reproduces the data based on this pit train etc. without affecting it in any way.

[0012] Moreover, apply to an optical disk and it sets to the pit or mark more than predetermined die length. Without affecting playback about the timing of these pits or the edge of a mark, if this pit or the width of face of a mark is modulated in the modulation part which estranged only predetermined distance and the data stream of ** is recorded from an edge The optical disk with which a pit or the width of face of a mark comes to record the data of ** can be obtained.
[0013] Moreover, if apply to an optical disk regenerative apparatus, and detect the signal level of a regenerative signal, a signal level detection result is obtained, the average value of this signal level detection result is identified and the data stream of ** is reproduced, it can add to the configuration which reproduces the main data recorded by the pit or the mark, and the data of ** recorded by a pit or the width of face of a mark can be reproduced.
[0014]
[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained in full detail, referring to a drawing suitably.
[0015] (1) The block diagram 1 of the gestalt of operation of the gestalt (1-1) 1st of the 1st operation is a block diagram showing the optical disk recording apparatus used for manufacture of a compact disk. The compact disk concerning the gestalt of this operation is manufactured like the conventional compact disk except for the point except disk original recording being created by this optical disk recording apparatus 1.
[0016] That is, the compact disk concerning the gestalt of this operation is created by the disk-like substrate created using a stamper by carrying out sequential formation of the reflective film, the protective coat, etc. Moreover, by carrying out electrocasting processing, a mother disk is created and this stamper is created using this mother disk, after developing the disk original recording 2 exposed by the optical disk recording apparatus 1.
[0017] This disk original recording 2 applies a sensitization agent to a flat glass substrate, and is formed, for example. A spindle motor 3 carries out the rotation drive of the disk original recording 2 by control of the spindle servo circuit 4. At this time, a spindle motor 3 outputs the FG signal FG to which signal level starts for every predetermined angle of rotation with FG signal generator formed in the pars basilaris ossis occipitalis. The spindle servo circuit 4 drives a spindle motor 3 so that the frequency of this FG signal FG may turn into predetermined frequency, and thereby, it carries out the rotation drive of the disk original recording 2 according to the conditions of a constant linear velocity.
[0018] The laser 5 for record is constituted by gas laser etc., and injects the laser beam L of the predetermined quantity of light. An optical modulator 6 is constituted by the electric acoustooptics component etc., and according to the modulating signal S3 supplied from the 2nd modulation circuit 7, on-off control of the laser beam L which carries out incidence from the laser 5 for record is carried out, and it injects it.
[0019] A mirror 8 bends the optical path of a laser beam L, and injects it towards the

disk original recording 2. An objective lens 9 condenses the reflected light of this mirror 8 on the recording surface of the disk original recording 2. The mirror 8 and the objective lens 9 are made as [carry out / radial / synchronizing with rotation of the disk original recording 2 / according to the thread device which is not illustrated / sequential migration]. Thereby, with the optical disk recording apparatus 1, the sequential variation rate of the condensing location of a laser beam L is made to carry out for example, in the direction of a periphery of the disk original recording 2, and a truck is spirally formed on the disk original recording 2. Moreover, the pit train according to a modulating signal S3 is formed on this truck at this time.
[0020] A digital audio tape recorder 10 outputs a digital audio signal D1 according to the array of the time series recorded on the disk original recording 2. A modulation circuit 11 performs data processing as which the compact disk was specified based on the sub-code data supplied from this digital audio signal D1 and the sub-code generator which is not illustrated, and generates the EFM signal S2. That is, a modulation circuit 11 generates the EFM signal S2 by carrying out interleave processing and carrying out eight-to-fourteen modulation further, after adding an error correcting code to the audio data D1 and sub-code data.
[0021] In this way, in the conventional optical disk recording device, the EFM signal S2 created by doing in this way will be supplied to the direct optical modulator 6, on-off control of the laser beam L will be carried out with this EFM signal S2, and sequential exposure of the disk original recording 2 will be carried out.
[0022] On the other hand, this optical disk recording apparatus 1 generates the disk identification code SC 1 by the disk identification code generating circuit 12 during the period corresponding to lead-in groove area, and in the 2nd modulation circuit 7, after it modulates the EFM signal S2 by this disk identification code SC 1, it outputs it to an optical modulator 6.
[0023] The disk identification code SC 1 is constituted by the information which controls ID information set up as a peculiar thing for every disk original recording, the information concerning a plant, the date of manufacture, and copy good / failure here. In addition, in addition to the disk identification code SC 1, the disk identification code generating circuit 12 carries out the sequential output of the synchronizing signal showing initiation of the disk identification code SC 1, and the error correcting code of the disk identification code SC 1.
[0024] That is, in the disk identification code generating circuit 12, N-ary counter 12A is constituted by the ring counter, counts the frame clock FCK outputted from the 2nd modulation circuit 7, and outputs counted value CT1. as shown in drawing 2 here, the frame sink of a 22-channel clock is inserted by the modulation circuit 11 for every 588-channel clock, and, as for the EFM signal S2 (drawing 2 (A-1) -- and (A-2)), a frame is constituted. To the timing of initiation of a frame sink, as for the frame clock FCK, only 1 clock period is generated so that signal level may start (drawing 2 (B) and (C)). By this, N-ary counter 12A will count a frame one by one on the basis of

this frame sink, and will output a count result.
[0025] Disk identification code table 12B consists of read-only-memory circuits holding the bit information by the disk identification code SC 1, and outputs the data which made counted value CT1 the address input, and held it. At this time, by outputting the held data using bit information, disk identification code table 12B assigns 1-bit data to (drawing 2 (D)) and the frame of 1 one by one, and outputs them to them.
[0026] The 2nd modulation circuit 7 generates the modulating signal S3 which modulates the EFM signal S2 by this disk identification code SC 1, and becomes with the so-called double modulating signal.
[0027] Drawing 3 is the block diagram showing this 2nd modulation circuit 7 in a detail. In this 2nd modulation circuit 7, from the EFM signal S2, the synchronous detector 21 detects a frame sink and outputs the frame clock FCK.
[0028] As shown in drawing 4 , the PLL circuit 22 reproduces and outputs the channel clock CK from the EFM signal S2 (drawing 4 (A)) (drawing 4 (B)). After the M sequence generating circuit's 23 being constituted by two or more flip-flops and IKUSUKURUSHIBUOA circuits by which cascade connection was carried out and setting initial value to the flip-flop of these plurality on the basis of the frame clock FCK, while carrying out the sequential transfer of the set contents synchronizing with the channel clock CK, logic 1 and logic 0 generate the random-number data MS of an M sequence which appear in same probability by returning by predetermined interstage. Thereby, the M sequence signal MS serves as a sequence of the pseudo-random number which repeats the same pattern with the period (period of one frame) of a 588-channel clock.
[0029] The IKUSUKURUSHIBUOA circuit (XOR) 24 receives the M sequence signal MS and the disk identification code SC 1, and outputs this exclusive-OR signal MS 1 (drawing 4 (D)). That is, the IKUSUKURUSHIBUOA circuit 24 outputs the exclusive-OR signal MS 1 with the logical level of the M sequence signal MS, when the disk identification code SC 1 is logic 0, and when the disk identification code SC 1 is logic 1 contrary to this, it outputs the exclusive-OR signal MS 1 which comes to be reversed of the logical level of the M sequence signal MS. The IKUSUKURUSHIBUOA circuit 24 will modulate the disk identification code SC 1 with an M sequence random number by this.
[0030] A flip-flop 25 latches the exclusive-OR signal MS 1 by the timing of the standup of the EFM signal S2 (drawing 4 (E)). It is set up so that the signal level of a modulating signal S3 may start in the gestalt of this operation corresponding to the standup of the signal level of the EFM signal S2, and a pit is formed in the disk original recording 2 here corresponding to the period when the signal level of this modulating signal S3 has started. By this, a flip-flop 25 will sample the logical level of the exclusive-OR signal MS 1 to the timing corresponding to the front edge of each pit, and a sampling result will be held to the timing corresponding to the front edge of the

continuing pit.
[0031] A delay circuit 26 carries out predetermined period delay of the latch result MSH of this flip-flop 25, and outputs the delay signal MSHD (drawing 4 (F)). The or more [7] T detector 27 is the time amount which processing takes, and this delay period is a period for about 5 clocks of the channel clock CK here.
[0032] The or more [7] T detector 27 detects the pulse width of the EFM signal S2, and when pulse width is more than 7T, it outputs the detection pulse SP of one-channel clock width of face (drawing 4 (G)). That is, as shown in drawing 5 , in the or more [7] T detector 27, eight steps of latch circuits 28A-28H latch and transmit the EFM signal S2 one by one synchronizing with the channel clock CK. AND circuit 29 inputs the latch output of these latch circuits 28A-28H into parallel. At this time, AND circuit 29 reverses and inputs the logical level of a latch output only about latch circuit 28H of the last stage, and outputs the AND signal of these parallel input. Thereby, AND circuit 29 outputs the AND signal which starts in logic 1, when the EFM signal S2 is seen a channel clock CK period and seven logic 1 comes to continue from one logic 0 (i.e., only when the pit beyond periodic 7T is formed to the primitive period T of the EFM signal S2).
[0033] A latch circuit 30 latches the output of this AND circuit 29, and outputs the detection pulse SP.
[0034] AND circuit 32 outputs an AND signal with the delay signal MSHD outputted from (drawing 3), and this detection pulse SP and delay circuit 26. Monostable multivibrator (MM) 33 makes the output of this AND circuit 32 a trigger, and outputs the pulse MMP (drawing 4 (H)) for a modulation of predetermined pulse width shorter than one period of the channel clock CK. In addition, when the exposure of a laser beam L is temporarily suspended by this pulse MMP for a modulation, in the compact disk created by the disk original recording 2, pit width of face decreases by this temporary halt, and this pulse width is set up here so that extent of this reduction may be set to about 10 [%] of average pit width of face.
[0035] Only the period of about 5 clocks delays the EFM signal S2, and a delay circuit 36 outputs it, and the IKUSUKURUSHIBUOA circuit (XOR) 37 calculates the exclusive OR of EFM signal S2D (drawing 4 (C)) outputted from the delay circuit 36, and the pulse MMP for a modulation, and it generates the modulating signal S3 (drawing 4 (I)) which comes to become the EFM signal S2 irregular by the disk identification code SC 1.
[0036] In carrying out, in the pit beyond periodic 7T, the time delay in this delay circuit 36 to write is selected at the time of playback so that the change rate of the logical level of the modulating signal S3 corresponding to this pulse MMP for a modulation may not affect the timing of the edge by the EFM signal S2 at the time of playback. The change rate of the logical level of the modulating signal S3 corresponding to the pulse MMP for a modulation concretely this time delay It is set up so that it may become the timing which estranged only the predetermined period

from the timing of the standup of the EFM signal S2. With the gestalt of this operation, only the period of about 5 clocks delays the EFM signal S2, and with it, it is set up so that the standup of EFM signal S2D which corresponds from the standup of the pulse MMP for a modulation may precede T or more [abbreviation period 3].
[0037] Drawing 6 is the top view showing the pit configuration of the compact disk created by the disk original recording 2 by contrast with the conventional compact disk. A pit and a land are only repeatedly formed of the die length of the integral multiple of 1 clock-period T of the channel clock CK with which the conventional compact disk becomes with a primitive period according to (drawing 6 (A)) and audio data. On the other hand, only the predetermined distance L is estranged from the edge of a pit, it will be formed so that the width of face of a pit may decrease locally according to the disk identification code SC 1, and the disk identification code SC 1 will be recorded by this pit width of face so that an arrow head a may show the compact disk concerning the gestalt of this operation in the pit of the die length beyond periodic 7T of (drawing 6 (B)) and these pits.
[0038] Drawing 7 is the block diagram showing the compact disc player which plays this compact disk 41. In this compact disc player 40, a spindle motor 42 carries out the rotation drive of the compact disk 41 on condition that a constant linear velocity by control of the servo circuit 43.
[0039] An optical pickup 44 receives the return light while irradiating a laser beam at a compact disk 41, and it outputs the regenerative signal RF with which signal level changes according to the quantity of light of return light. Signal level will change here corresponding to the pit where this regenerative signal RF was recorded on the compact disk 41. The signal level of a regenerative signal RF will change according to this pit width of face by being formed in the compact disk 41, at this time, so that pit width of face may reduce only about 10 [%] locally from average pit width of face. however, the timing to which a regenerative signal RF crosses the reference level of binary discernment by estranging only predetermined distance from the edge of each pit, and being created so that the timing of an edge may not be affected -- in any way -- pit width of face -- width of face -- it is maintained by the same timing as the case where it is not created narrowly.
[0040] By these, the binary-ized circuit 45 makes this regenerative signal RF binary with predetermined reference level, and creates the binary-ized signal BD. Since reduction extent of the local pit width of face in a compact disk 41 in carrying out to write becomes by 10 [%], in the binary-ized signal BD, the fall of this local pit width of face will be detected.
[0041] The PLL circuit 46 reproduces the channel clock CCK of a regenerative signal RF by operating on the basis of this binary-ized signal BD.
[0042] The EFM demodulator circuit 47 reproduces the playback data corresponding to the EFM signal S2 by carrying out the sequential latch of the binary-ized signal BD on the basis of the channel clock CCK. Furthermore, after the EFM demodulator

circuit 47 carries out the EFM recovery of this playback data, on the basis of a frame sink, it carries out the day interleave of the signal of a break and generated 8 bitwises by 8 bitwises, and outputs this recovery data to the ECC (Error Correcting Code) circuit 48.

[0043] Based on the error correcting code added to the output data of this EFM demodulator circuit 47, the ECC circuit 48 carries out error correction processing of these output data, and, thereby, reproduces and outputs the audio data D1.

[0044] The digital-to-analog conversion circuit (D/A) 49 carries out digital-to-analog transform processing of the audio data outputted from this ECC circuit 48, and outputs audio signal S4 which becomes with an analog signal. At this time, the digital-to-analog conversion circuit 49 will stop the output of audio signal S4, if this compact disk 41 is judged to be what is depended on an illegal copy by control of the system control circuit 50.

[0045] The system control circuit 50 is constituted by the computer which controls actuation of this compact disc player 40. When the system control circuit 50 accesses lead-in groove area, and it judges whether it is what a compact disk 41 depends on an illegal copy based on the disk identification code SC 1 outputted from the disk identification code regenerative circuit 51 and it is judged to be what is depended on an illegal copy it, it carries out halt control of the output of audio signal S4 from the digital-to-analog conversion circuit 49. [it]

[0046] The disk identification code regenerative circuit 51 decodes and outputs the disk identification code SC 1 from a regenerative signal RF.

[0047] Drawing 8 is the block diagram showing this disk identification code regenerative circuit 51 in a detail. in this disk identification code regenerative circuit 51, as shown in drawing 9 , the alignment pattern detector 53 carries out the sequential latch of the binary-ized signal BD (drawing 9 (A-1) -- and (A-2)) on the basis of the channel clock CCK (drawing 9 (B)), and detects a frame sink by judging that continuous logical level. Furthermore, the alignment pattern detector 53 outputs the clear pulse FCLR to which signal level starts during the period of the one-channel clock CCK following the set pulse FSET to which signal level starts, and this set pulse FSET during the period of the one-channel clock CCK which each frame starts on the basis of this detected frame sink (drawing 9 (D) and (C)).

[0048] The pit detector 54 is constituted like the or more [7] T detector 27 of the optical disk recording apparatus 1 (drawing 5), and detects the timing of the binary-ized signal BD corresponding to the pit which has the die length beyond periodic 7T by replacing with the FEM signal S2 on the basis of the channel clock CCK, and carrying out the sequential transfer of the binary-ized signal BD. Furthermore, signal level starts and starts to the timing of initiation of this detected pit, and the pit detector 54 generates and outputs Signal PT. Gate signal CT to which predetermined period delay is carried out and signal level furthermore starts from this standup signal PT is outputted. In addition, this gate signal CT will correspond to the pulse MMP for

a modulation of the 2nd modulation circuit 7, and differs in the pulse MMP for a modulation, and signal level starts in each pit which has the die length beyond periodic 7T.
[0049] The M sequence generation circuit 55 generates the M sequence signal corresponding to the M sequence signal MS generated with the optical disk recording device 1 by carrying out stepping of the address one by one with the channel clock CCK, and accessing a built-in read-only memory, after initializing the address by the clear pulse FCLR. After latching an M sequence signal by the timing of pit initiation which has the die length beyond periodic 7T by the M sequence generation circuit's 55 starting furthermore, and latching and outputting this M sequence signal on the basis of Signal PT, the M sequence latch signal MZ which comes to hold till the pit initiation which has the die length beyond periodic 7T which continues this latched logical level is outputted.
[0050] The analog-to-digital-conversion circuit (A/D) 57 carries out analog-to-digital-conversion processing of the regenerative signal RF on the basis of the channel clock CCK, and outputs a 8-bit digital regenerative signal. The polarity-reversals circuit (-1) 58 reverses and outputs the polarity of this digital regenerative signal.
[0051] A selector 59 carries out the selection output of the digital regenerative signal by which a direct input is carried out from the analog-to-digital-conversion circuit 57, and the digital regenerative signal which comes to be reversed of the polarity inputted from the polarity-reversals circuit 58 according to the logical level of the M sequence latch signal MZ outputted from the M sequence generation circuit 55. That is, a selector 59 chooses and outputs the digital regenerative signal by which a direct input is carried out when the M sequence latch signal MZ is logic 1, and when the M sequence latch signal MZ is logic 0 contrary to this, it chooses the digital regenerative signal by which polarity reversals were carried out. Thereby, this selector 59 reproduces the logical level of the disk identification code SC 1 modulated with the M sequence signal MS with the data of a multiple value, and outputs the playback data RX based on the data of this multiple value.
[0052] An adder 60 is a 16-bit digital adder, and adds and outputs the playback data RX and the output data AX of an accumulator (ACU) 61. An accumulator 61 consists of 16-bit memory holding the output data of an adder 60, and constitutes an accumulation machine with an adder 60 by returning the held data to an adder 60. That is, an accumulator 61 incorporates the output data of an adder 60 by the timing of gate signal CT, after clearing the contents held by the clear pulse FCLR. Thereby, an adder 60 accumulates the logical value of the playback data RX reproduced by the selector 59 for every frame, and outputs the accumulation value AX.
[0053] By clearing the contents held by the clear pulse FCLR, and counting gate signal CT, the pit counter 62 counts the number of pits which carried out accumulation in the accumulator 61, and outputs counted value NX.

[0054] Division circuit (/) 63 average-izes the logical value of the playback data RX reproduced by the selector 59 by doing the division of the accumulation value AX outputted from an accumulator 61 by counted value NX. The binary-ized circuit 64 is the timing to which a set pulse FSET starts, makes binary the output data BX of the division circuit 63 with a predetermined reference value, and outputs. The playback data RX of the disk identification code SC 1 reproduced by the selector 59 by this are changed into the binary disk identification code SC 1.
[0055] The ECC circuit 65 carries out error correction processing of the disk identification code SC 1 with the error correcting code added to this disk identification code SC 1, and outputs.
[0056] (1-2) In the configuration beyond actuation of the gestalt of the 1st operation, in the optical disk recording apparatus 1 (drawing 1), after sequential exposure of the disk original recording 2 is carried out by the digital audio signal D1 outputted from a digital audio tape recorder 10 and a mother disk is created, by the production process of the compact disk 41 concerning the gestalt of this operation, it is created from this mother disk.
[0057] In exposure of this disk original recording 2, in a modulation circuit 11, a digital audio signal D1 makes a primitive period the 1 period T of the channel clock CK, and is changed into the EFM signal S2 with which signal level switches with the period of the integral multiple of this primitive period T. Moreover, in lead-in groove area, it replaces with a digital audio signal D1, and the data stream of TOC is similarly changed into the EFM signal S2.
[0058] Furthermore, these EFM(s) signal S2 is changed into a modulating signal S3 through the 2nd modulation circuit 7, drives an optical modulator 6 with this modulating signal S3, and is recorded on the disk original recording 2. Thereby, a digital audio signal D1 is recorded on the disk original recording 2 by the repeat of the pit by the die length of the integral multiple of the die length of the base corresponding to one period of the channel clock CK, and a land with the data stream of TOC.
[0059] In case this EFM signal S2 is changed into a modulating signal S3, it sets to fields other than lead-in groove area. It sets in lead-in groove area to a modulating signal S3 being created so that it may correspond to the signal level of the EFM signal S2. The signal level of the EFM signal S2 is switched locally, a modulating signal S3 is generated, and the pit where width of face is narrow is locally created in the pit train created by the disk original recording 2 by this. Pit width of face is modulated by this, and the disk identification code SC 1 is recorded on the disk original recording 2.
[0060] That is, in the disk identification code generating circuit 12, when the frame clock FCK counts by N-ary counter 12A and disk identification code table 12B is accessed by this counted value, the disk identification code SC 1, the error correcting code of this disk identification code SC 1, etc. are generated by the binary number with the low frequency which comes to assign 1 bit to one frame.

[0061] Furthermore in the M sequence generating circuit 23 of the 2nd modulation circuit 7 (drawing 3), the random-number data MS of the M sequence repeated with a frame period synchronizing with the channel clock CK are generated, and the random-number data MS of this M sequence and the exclusive OR of the disk identification code SC 1 are acquired in the IKUSUKURUSHIBUOA circuit 24. Since the disk identification code SC 1 is modulated with the random-number data MS by this and logic 1 and logic 0 appear in same probability in the random number of an M sequence, the disk identification code SC 1 is similarly modulated for logic 1 and logic 0 by the exclusive-OR signal MS 1 which appears in same probability.
[0062] Furthermore in a flip-flop circuit 25, the exclusive-OR signal MS 1 is latched by the rising edge of the EFM signal S2 corresponding to the edge of each pit. In the or more [7] T detector 27, the standup of the signal level of the EFM signal S2 corresponding to the pit beyond periodic 7T is detected by the pan to a primitive period T, and the latch result of the flip-flop circuit 25 corresponding to the standup of this signal level is chosen as it by AND circuit 32. Monostable multivibrator 33 drives with the output of this AND circuit 32 by this, and the signal level of the EFM signal S2 is locally switched by the output of this monostable multivibrator 33 in the IKUSUKURUSHIBUOA circuit 37.
[0063] Thereby, in the pit beyond periodic 7T, the disk identification code SC 1 reduces pit width of face locally, and is recorded on the disk original recording 2. Moreover, in the disk original recording 2, when the AND of the M sequence random-number data MS and the disk identification code SC 1 is logic 1, and when the die length of a pit is more than 7T, a pit will decrease partially and a pit train will be created one by one.
[0064] Moreover, the pulse MMP for a modulation outputted from monostable multivibrator 33 is received in doing in this way, switching the logical level of the EFM signal S2, generating a modulating signal S3, and creating a narrow pit. The EFM signal S2 is delayed by the delay circuit 36, the IKUSUKURUSHIBUOA circuit 37 is supplied, and thereby, at the time of playback, the change rate of the logical level of a modulating signal S3 is set up so that the timing of the edge by the EFM signal S2 may not be affected.
[0065] Namely, on the assumption that pit width of face is reduced in the pit beyond periodic 7T The change rate of the logical level of the modulating signal S3 corresponding to the pulse MMP for a modulation So that it may become the timing which estranged only the predetermined period from the timing of the standup of the EFM signal S2 (it corresponds to distance L from the edge of the pit in drawing 6) It is set up so that the standup of EFM signal S2D which corresponds from the standup of the pulse MMP for a modulation may precede T or more [abbreviation period 3].
[0066] The disk identification code SC 1 is recorded so that the edge information on each pit which serves as playback criteria of a digital audio signal and TOC data by this may not be affected.

[0067] Moreover, the binary discernment which the regenerative signal RF by having recorded the disk identification code SC 1 mistook is prevented by setting the pulse width of the pulse MMP for a modulation outputted from this monostable multivibrator 33 as die length shorter than one period of the channel clock CK, and 10[%] pit width of face's decreasing, and forming a narrow pit locally from average pit width of face, by this.
[0068] Furthermore, locally pit width of face 10 [%] reduction by having carried out and having recorded the disk identification code SC 1 When logic 1 and logic 0 furthermore modulated the disk identification code SC 1 with the M sequence random-number data MS which appear in same probability It is observed like the noise which change of a regenerative signal RF mixes in a regenerative signal RF by change of pit width of face, and, thereby, the disk identification code SC 1 can be made into observation and discovery difficulty. Furthermore, the copy of the disk identification code SC 1 can also be made difficult.
[0069] Moreover, even if it changes a regenerative signal by a noise etc. by having assigned 1 bit of the disk identification code SC 1 to one frame in addition to these, the disk identification code SC 1 is certainly reproducible.
[0070] That is, by detecting the regenerative signal RF with which signal level changes according to the quantity of light of the return light obtained by the compact disk 41 created by doing in this way irradiating a laser beam in (drawing 7) and a compact disc player 40, the signal level of this regenerative signal RF will change according to pit width of face, and this regenerative signal RF is made binary by the binary-ized circuit 45. Then, after binary discernment of the binary-ized signal BD is carried out by the EFM demodulator circuit 47, it EFM-gets over, and a day interleave is carried out, error correction processing is carried out by the ECC circuit 48, and, thereby, a digital audio signal D1 is reproduced.
[0071] At this time, it sets to a compact disk 41. Reduction of local pit width of face in the pit beyond periodic 7T And when it estranges beyond the distance corresponding to periodic 3T and pit width of face is decreasing from the edge (they are the both sides of a front edge and a back edge) of a pit The beam spot by the laser beam scans the edge of a pit, and the part which pit width of face reduced by different timing, and, thereby, the effect which comes to decrease pit width of face locally is avoided in a regenerative signal RF. That is, in a compact disk 41, change of signal level [/ near / each / the edge by having made the pit narrow] is prevented, and even if it is the compact disk which recorded the disk identification code by this, it becomes possible to reproduce correctly with the usual compact disc player.
[0072] Thus, in playback of the digital audio signal D1 performed, when the disk identification code SC 1 recorded by pit width of face in lead-in groove area is reproduced in advance and this disk identification code SC 1 cannot play a compact disk 41 correctly, halt control of the digital-to-analog transform processing by the digital-to-analog conversion circuit 49 is carried out as an illegal copy.

[0073] Namely, in playback (drawing 8) of the disk identification code SC 1 in this lead-in groove area, in the alignment pattern detector 53, a frame sink is detected and, as for a compact disk 41, the random-number data MZ corresponding to the M sequence random-number data at the time of record are generated in the M sequence generation circuit 55 on the basis of detection of this frame sink.
[0074] Moreover, a regenerative signal RF is changed into a digital regenerative signal by the analog-to-digital-conversion circuit 57, and the playback data RX which come to express the logical level of the disk identification code SC 1 with the data of a multiple value are reproduced by choosing the digital regenerative signal which comes to be reversed of this digital regenerative signal or a polarity with a selector 59 on the basis of the M sequence random-number data MZ.
[0075] When pit width of face is reducing only 10 [%], and this playback data RX is seen per 1 sample, its SN ratio will be very bad. In a compact disk 41, after this playback data RX is accumulated per frame by the accumulator 61 and the adder 60, a division is done by the division circuit 63, it is average-ized, and, thereby, an SN ratio is improved. After the output data BX of this division circuit 63 are made binary by the binary-ized circuit 64 in this way and the disk identification code SC 1 is decoded, error correction processing is carried out by the ECC circuit 65, and it is outputted to the system control circuit 50.
[0076] (1-3) According to the configuration beyond the effectiveness of the gestalt of the 1st operation, about the pit more than the die length corresponding to periodic 7T By changing pit width of face to the timing which estranged only predetermined distance from the timing corresponding to the edge of a pit based on the disk identification code SC 1 The disk identification code SC 1 can be recorded on playback of the digital audio signal D1 by the pit train refreshable using the optical pickup which reproduces this digital audio signal D1 without affecting it in any way. Thereby, an illegal copy can be eliminated using this disk identification code SC 1.
[0077] Moreover, in the 2nd modulation circuit, the pit more than the die length corresponding to periodic 7T is detected at this time. By reversing the signal level of the EFM signal S2 to the timing which estranged only the predetermined period, and generating a modulating signal S3 from the timing corresponding to the edge of this detected pit, according to the disk identification code SC 1 Simply and certainly, the disk identification code SC 1 can be recorded on playback of the digital audio signal D1 by the pit train without affecting it in any way.
[0078] By modulating the disk identification code SC 1 with the M sequence random-number data MS furthermore, and generating the modulating-signal signal S3, the disk identification code SC 1 can be recorded on a noise and discernment difficulty, and the disk identification code SC 1 can be made into discovery and analysis difficulty. Moreover, at the time of playback, the effect of a noise can be avoided effectively and the disk identification code SC 1 can be reproduced.
[0079] Moreover, by setting the period which reverses the signal level of this

modulating signal S3, and makes pit width of face narrow as a period shorter than the 1 period T of the channel clock CK which becomes with a primitive period, similarly, the disk identification code SC 1 can be recorded on a noise and discernment difficulty, and the disk identification code SC 1 can be made into discovery and analysis difficulty.

[0080] Moreover, by having set change of pit width of face as 10 [%] of the average width of face of a pit, similarly, the disk identification code SC 1 can be recorded on a noise and discernment difficulty, and the disk identification code SC 1 can be made into discovery and analysis difficulty.

[0081] Moreover, in a compact disc player, the disk identification code SC 1 recorded on a noise and discernment difficulty is certainly reproducible by removing the effect of the noise which detected the signal level of a regenerative signal RF, decoded the disk identification code SC 1, detected the average value of this signal level, and was mixed in the disk identification code.

[0082] Moreover, the disk identification code SC 1 which the count of an appearance in one frame assigned and recorded on the indefinite pit beyond periodic 7T is certainly reproducible by having constituted the average-ized means by the accumulation machine by the accumulator 61 and the adder 60, and the counted value by the pit counter 62 at this time.

[0083] Moreover, ** which reproduces certainly the disk identification code SC 1 recorded on discovery and analysis difficulty is made by processing a digital regenerative signal alternatively with the M sequence random-number data MZ in a selector 59, and reproducing the disk identification code SC 1.

[0084] (2) it is the gestalt of other operations -- in the gestalt of above-mentioned operation, although the case where a disk identification code was modulated with the M sequence random-number data which synchronized with the channel clock CK was described, this invention may generate M sequence random-number data synchronizing with the EFM signal S2 by replacing for example, not only with this but with the channel clock CK, and supplying the EFM signal S2 to the M sequence generating circuit 23.

[0085] Moreover, although the gestalt of above-mentioned operation described the case where modulated pit width of face and a disk identification code was recorded about the pit beyond periodic 7T, if there is this invention when the reversion system has sufficient allowances to the jitter of not only this but a regenerative signal, even if it modulates pit width of face about the pit beyond periodic 6T, it can acquire the same effectiveness.

[0086] Moreover, although the gestalt of above-mentioned operation described the case where estranged only predetermined distance and pit width of face was reduced from the edge of a pit, this invention may reduce pit width of face in the center of each pit about the pit more than predetermined die length, as shown not only in this but in drawing 10 (A).

[0087] Furthermore, with the gestalt of above-mentioned operation, although the case where reversed the signal level of the EFM signal S2 locally, and pit width of face was modulated was described, this invention may modulate pit width of face by modulating the quantity of light of not only this but a laser beam. If it does in this way, as shown in drawing 10 (B), pit width of face can also be modulated so that pit width of face may increase locally. Moreover, as shown in drawing 10 (C), by increase of local pit width of face, and reduction, a disk identification code can also be recorded with three values, extent of this increase and extent of reduction can be set up further gradually, and a disk identification code can also be recorded by many multiple-value records from three values. Moreover, as shown in drawing 10 (D), pit width of face can be changed in a period longer than one period of a channel clock, and the data of ** can also be recorded.
[0088] Although the gestalt of above-mentioned operation furthermore described the case where a 1-bit disk identification code was assigned and recorded on one frame This invention not only in this For example, when a 1-bit disk identification code is assigned for every number of appointed numbers about the pit more than predetermined die length, Furthermore, during a predetermined period, when assigning a sequential circulation target a two or more bits disk identification code in the pit more than predetermined die length, an approach to assign versatility can be applied. In addition, when assigning a 1-bit disk identification code for every number of appointed numbers, the pit counter 62 by the side of playback and the division circuit 63 can be omitted.
[0089] Moreover, although the case where a disk identification code was recorded with pit width of face was described in the gestalt of above-mentioned operation This invention records the digital audio signal enciphered not only by this but by a pit and a land. When recording key information required for discharge of this encryption with pit width of face and recording data still more nearly required for selection of key information, and decode with pit width of face, various data required for discharge of encryption may be recorded with pit width of face.
[0090] Moreover, in the gestalt of above-mentioned operation, although the case where modulated the pit width of face of lead-in groove area, and the data stream of ** was recorded to the main data streams by the pit and the land was described, this invention can modulate pit width of face in various fields, such as not only this but user area, and can record the data of **. In addition, it is good even if discovery of the field which pit width of face was changed also in the field which is not recording the data of ** at all in these cases, and recorded the data of ** by this is difficult.
[0091] Although the case where made it binary, respectively and a digital audio signal and a disk identification code were reproduced was furthermore described in the gestalt of above-mentioned operation, this invention can apply widely the various discernment approaches, such as not only this but Viterbi decoding.
[0092] Moreover, in the gestalt of above-mentioned operation, although the case

where carried out eight-to-fourteen modulation and a digital audio signal was recorded was described, this invention is widely applicable to various modulations, such as not only this but 1-7 modulation, 8-16, 2-7 modulation, etc.
[0093] Moreover, in the gestalt of above-mentioned operation, although the case where desired data were recorded by the pit and the land was described, this invention can be widely applied, not only this but when recording desired data by the mark and the tooth space.
[0094] Moreover, in the gestalt of above-mentioned operation, although the case where an audio signal was recorded on a compact disk and its peripheral device with the application of this invention was described, this invention is widely applicable to various optical disks, such as not only this but a videodisk, and the peripheral device of those.
[0095]
[Effect of the Invention] As mentioned above, according to this invention, to the timing which does not affect the positional information of an edge, the data stream of ** can be recorded refreshable by the optical pickup which reproduces this main data stream without affecting playback of the main data streams by the pit train and the mark train in any way by changing a pit or the width of face of a mark.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the block diagram showing the optical disk recording apparatus concerning the gestalt of operation of the 1st of this invention.
[Drawing 2] It is the timing diagram which shows the relation between a frame and a frame sink.
[Drawing 3] It is the block diagram showing the 2nd modulation circuit of drawing 1 .
[Drawing 4] It is the timing diagram with which explanation of actuation of the 2nd modulation circuit of drawing 3 is presented.
[Drawing 5] It is the block diagram showing or more [7] T detector of drawing 4 .
[Drawing 6] It is the top view showing the pit configuration of a compact disk with the optical disk recording apparatus of drawing 1 .
[Drawing 7] It is the block diagram showing the compact disc player with which playback of the compact disk of drawing 6 is presented.
[Drawing 8] It is the block diagram showing the disk identification code regenerative circuit of the compact disc player of drawing 7 .
[Drawing 9] It is the timing diagram with which explanation of actuation of the disk identification code regenerative circuit of drawing 8 is presented.

[Drawing 10] It is the top view showing the pit configuration of the compact disk concerning the gestalt of other operations.

[Description of Notations]

1 [.. The 2nd modulation circuit, 11 / .. A modulation circuit, 12 / .. A disk identification code generating circuit, 12B / .. 23 A disk identification code table, 55 / .. 24 An M sequence generating circuit, 37 / .. An IKUSUKURISHIBUOA circuit, 27 / .. Or more / 7 / T detector, 40 / .. A compact disc player, 41 / .. A compact disk, 51 / .. Disk identification code regenerative circuit] .... An optical disk recording apparatus, 2 .. Disk original recording, 6 .. An optical modulator, 7